

THE GEOGRAPHICAL INFORMATION SYSTEM OF CESIS PROJECT

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CESIS PROJECT

CE.S.I.S. project, promoted by the *National Institute of Geophysics and Volcanology* and funded by Ministry of Instruction, University, and Scientific Research (MIUR) foresees the realization of a permanent seismic, accelerometric and geodetic network in Southern Italy, and the consequent realization of a Research Centre for seismology and seismic engineering.

The project, started three years ago, is now in an advanced phase for the installation of the monitoring stations and since march 2004 is completely in activity the *Seismology and Seismic Engineering Centre* in Grottaminarda (Avellino's province), about 50 Km far from Naples in the Irpinia region, epicenter of the devastating 1980 earthquake (Magnitude 6.9 - about 3000 victims).

The technological and research activities of Grottaminarda 's Centre concern on the development of a monitoring network in southern Italy, composed by 60 co-located permanent GPS, broad-band seismometers and accelerometers integrating the existing national network.



Figure 1 – Home Page of INGV Grottaminarda (www.gm.ingv.it).

The aim is to improve the seismic monitoring and to develop the geophysical research in the area.

An important goal is the choice of satellite telemetry for data transmission.

This choice allows us to gain autonomy in the site identification and high quality of the data at low operating costs.

All the stations of the CESIS network are acquired in real time at the Centre.

THE GEOGRAPHICAL INFORMATION SYSTEM (SIT)

In the framework of the monitoring system, we develop an active *Digital Cartography and Geographic Database Laboratory (LABGIS)* to support the technicians and the researchers working in the laboratories and in the field activities.

Huge quantities of data are elaborated using the technology of the geographical information systems (GIS). All the recorded data are organized in geographic databases for cartographic report, scenes and simulations, and for their publication on WEB site and for scientific applications.

In this context, the Geographical Information System (SIT) is a main part of the CESIS Project, because it proposes to collect and to integrate cartographic and descriptive information for the analysis of the territorial, seismological and geological characteristics of South Italy.

The SIT has a double role: first, it is a support in the activities of the technicians and researchers, especially in *siting* of both seismic and GPS stations; second, with its huge amount of geographic information, it renders the starting base for applications Gis-based in the seismology and for evaluation of the seismic risk.

The geographic area interested by the SIT is composed by seven regions in southern Italy: Molise, Sardegna, Campania, Puglia, Basilicata, Calabria and Sicilia.

A fundamental phase for the realization of the SIT has been the collection of all territorial data, available or coming from other INGV Sections or from other State Agency (APAT, Civil Defense, Ministry of Environment) and their integration inside the geographic information system.

We used software by ESRI, ArcGIS release 9.0 with the *GEODATABASE* data model: this model makes use of "clever" geographic objects allowing the users to assign rules and usable behaviour in the applications of spatial analysis.

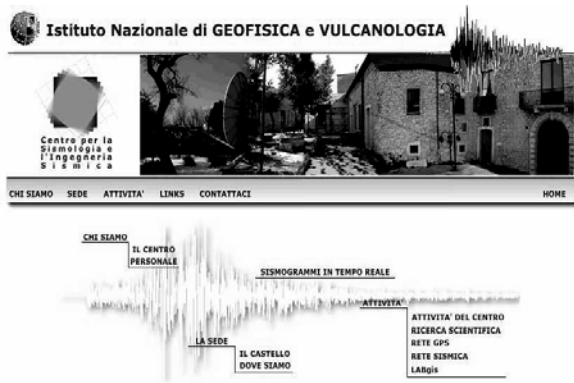


Figure 2 – Flowchart of the SIT.

The Geodatabase is stored inside a relational database, in this case Microsoft Access (.mdb), using a *Personal* solution that in future will be updated toward an *Enterprise* system that makes use of the potentiality of a RDBMS as Oracle.

The *SIT*, in its first phase, contains about 60 layers grouped in a series of *Feature Dataset*, defined for different typology of vectorial data that contains the single *Feature Class* (similar to *shapefiles*) and the relative Metadatas.

The subdivision of the geographic data is made on the base of their typology (territorial, geological, geophysical. ecc.) and on the reference system and coordinates adopted for every *Feature Dataset* (**FD**):

- **FD Inquadramento Geografico:** it contains the Feature Class (FC) of the target area of the *SIT* CESIS and the FC of the indexes of the Cartography

in different scale of the Italian Geographic Military Institute (IGM).

- **FD Limiti Amministrativi:** it contains FC of the Regional, Provincial and Municipal administrative boundaries.
- **FD Località:** it contains the FC related to the location of the main localities, town administrative centres and smallest towns with statistic information including telephone and Postal Code.
- **FD Viabilità:** it contains the FC relative to the most important roads of communication, motorways and railways.
- **FD Dati Territoriali:** it contains the FD relative to topography,
- **FD Dati Geologici:** it contains a geological database for the Area at 1: 500.000 scale ; the most recent seismic classification at municipality scale; the Seismogenic Areas and Geological/Geophysical Seismogenic Sources from the *Database of Individual Seismogenic Sources* (DISS 3) developed from the INGV.
- **FD Sismicità:** it is divided into three typology of seismicity data; the *historical seismicity* with the catalogues CFT, CPT, DOM and NT; the *instrumental seismicity* of the period 1981-2002 with the Italian Seismicity Catalogue (CSI 1.0); the INGV bulletin of the *instrumental seismicity* for the last 3 years, from 2003 to 2005.
- hydrographic network, Lakes and bathymetry.
- **FD Reti Monitoraggio:** it contains the FC of the Seismic, GPS and Accelerometric network of the CESIS project, subdivided in their temporal development; beside, there are the FC of the National Seismic Network and National Integrated GPS Network (RING).

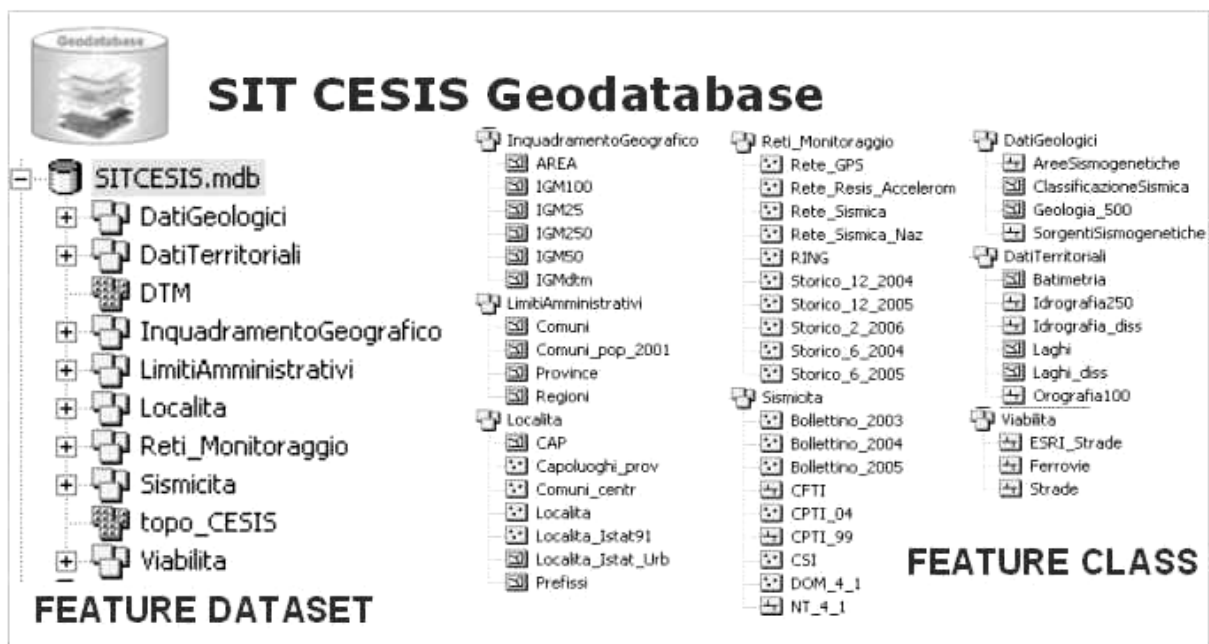


Figure 3 – Scheme of Geodatabase

Raster Data, instead, are organized into the *Raster Catalog (RC)* that allows us to obtain a complete spatial coverage of all territory by mosaic spatial functions.

- **RC TOPO_CESIS:** we have geo-referenced all the topographic maps of the IGM Cartography at the scale 1:50.000 and collected in the catalogue so as to have a homogeneous cartography for all the area of the CESIS.
- **RC DTM:** we obtained a DTM of the area with a dot pitch of 100 meters and have extracted the Layers for Hillshade, Slope and Aspect.

THE CESIS MAP SERVER

Data organization within Geodatabase allowed us the creation of *Gis-based* applications within which the development of the WEBGIS.

The WEBGIS is a user-friendly interface for reference to the territorial and cartographic data, and for checking the progress of the monitoring network of the CESIS Project.

The WEBGIS has been developed with ESRI ARCIMS 9.0 by the production of *map services* created in ArcGIS ArcMAP with the extension ArcMapServer.

Parts of data of the *SIT* have been selected to be published on WEB using fixed spaces of visualization and appropriate thematic classification.

The functionality of the Client (HTML Viewer type) allows the user to interact with the data using tools of territorial navigation (*pan* and *zoom*), interrogation and selection (*identify*, *query*, *select features*), spatial analysis (*buffer*), printing and maps exporting.

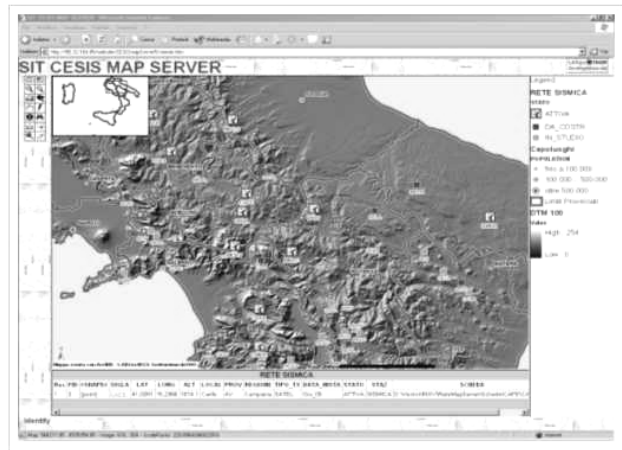


Figure 4 – CESIS MAP SERVER interface.

A customized functionality has been developed for the “Layer of the CESIS Seismic Network” to visualize the monography of the station with the corresponding information on the place, and for the “Layer of the CESIS GPS Network” with a connection to the database of “*National GPS Network*” (*RING*), in order to have the GPS files available for every station.

REFERENCES

M.PIGNONE, R. MOSCHILLO, G. SELVAGGI, M.MORO, B.CASTELLO, 2005. Il Geodatabase del Catalogo della Sismicità Italiana (CSI). Atti della Conferenza ASITA, Catania, novembre 2005.